IN-BEAM GAMMA-RAY SPECTROSCOPY OF TARGET FRAGMENTATION*

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Fragmentation reactions at energies ~E/A>50 MeV produce neutron-rich nuclei but leave little angular momentum in the residues. In this work we have examined the product distribution and angular momentum input for a ^{12}C beam at 30 MeV/A on a thick (40 mg/cm^2) target of ^{51}V, testing the feasibility of in-beam gamma-ray spectroscopy. With this technique it might be possible to study neutron-rich nuclei to moderate spins, complementing the now traditional beam fragmentation studies. The main advantage of the target fragmentation setup is that, for lifetimes longer than the stopping time (~1 ps), gamma rays are not Doppler broadened. The experiment was performed with the Gammasphere array and the beam delivered by the 88-inch cyclotron at LBNL.

We will present the results of this study in which some 70 different isotopes from F to Fe (Z=9-26) have been identified and new excited states found. The experimental isotopic yields, such as those shown in Figure 1, cannot be reproduced by LISE calculations [1], which are based on the abrasion-ablation model of fragmentation. Also, the maximum angular momentum of 12 that is observed experimentally is greater than that expected from a model [2] based on fragmentation. At the low energy of this experiment (30 MeV/A) a wide variety of reactions may be taking place including fragmentation, transfer, deep-inelastic, incomplete fusion, etc. More comprehensive reaction models, such as those using antisymmetrized molecular dynamics [3], could be appropriate and may be investigated in the future.

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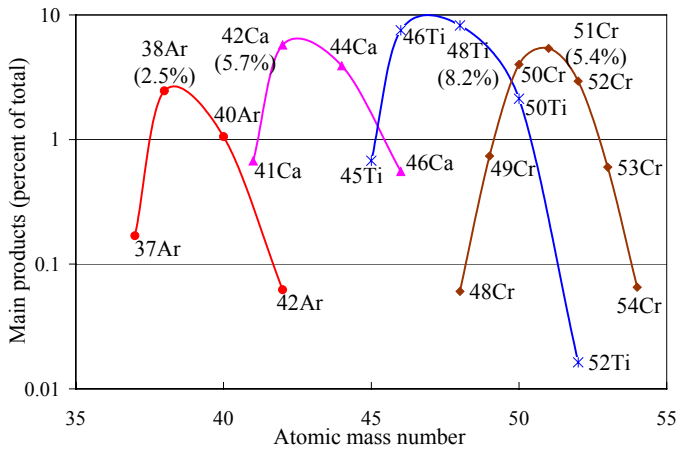

Figure 1. Selected yields observed in the experiment (30 MeV/A ^{12}C beam on a 40 mg/cm^2 ^{51}V target).